

2018

PHYSICS

[Core]

Paper — V

Full Marks : 60

Time : $2\frac{1}{2}$ hours

Answer all questions

The figures in the right-hand margin indicate marks

GROUP — A

1. **(a) Find the value of $H_0(x) + 2H_1(x)$. 3**
- (b) The error in the measurement of the radius of a sphere is 0.4%. What is the permissible error in the measurement of surface area ? 3**
- (c) Show that $P_n(-x) = (-1)^n P_n(x)$. 3**

(Turn Over)

✓ (a) Find the value of $\Gamma\left(\frac{1}{4}\right) \Gamma\left(\frac{3}{4}\right)$.

3

GROUP - B

✓ 2. (a) Deduce the relation

$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}.$$

6

(b) Find the Fourier series expansion of x^2 in the interval $-\pi < x < \pi$.

6

Or

(c) If $f(x) = x$, $-\pi < x < \pi$, then by integrating the fourier expansion of $f(x) = x$. Prove that

$$x^2 = \frac{\pi^2}{3} - 4 \left[\frac{\cos x}{1^2} - \frac{\cos 2x}{2^2} + \frac{\cos 3x}{3^2} - \dots \right].$$

12

✓ 3. (a) Integrate :

$$\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta.$$

6

(b) Show that

$$\Gamma(m) \Gamma(1-m) = \frac{\pi}{\sin m\pi}. \quad 6$$

Or

(c) Find the value of

$$\int_0^1 \frac{dx}{\sqrt{1-x^4}}. \quad 6$$

(d) Establish the relationship between Beta and Gamma Function. 6

4. (a) Write down Legendre's differential equation. Solve it by using series solution method. 6

(b) Prove that Legendre's polynomials are set of orthogonal function in the interval $(-1, 1)$ i.e.

$$\int_{-1}^1 P_m(x) P_n(x) dx = \frac{2}{2n+1} \delta_{mn}. \quad 6$$

Or

- (c) Solve the following differential equation by series solution method :

$$\frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} + 2ny = 0. \quad 6$$

- (d) Derive Rodrigue's formula for Hermite polynomials. 6

5. (a) Solve the equation

$$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$$

representing the vibration of a string of length l fixed at both ends, $y(0, t) = 0$,

$y(l, t) = 0$ $y(x, 0) = f(x)$ and $\frac{\partial}{\partial t} y(x, 0) = 0$,
 $0 < x < l$. 12

Or

- (b) Write down Laplace differential equation

(5)

in cylindrical coordinates. Hence obtain a solution by using variable-separable method. 6

- (c) A conducting sphere is placed in uniform electric field. Obtain an expression for potential. 6**
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2018

PHYSICS

[Core]

Paper — VI

Full Marks : 60

Time : $2\frac{1}{2}$ hours

Answer all questions

The figures in the right-hand margin indicate marks

GROUP — A

1. Write short notes on : 3 × 4
- (i) Zeroth law of Thermodynamics
 - (ii) Gibb's free energy
 - (iii) Cooling due to adiabatic demagnetization
 - (iv) Joule-Thomson cooling.

GROUP — B

2. (a) Differentiate between reversible and irreversible process with example. 6

(Turn Over)

(b) Derive; efficiency of an ideal Carnot's engine.

6

Or

✓(c) Clausius inequality – Derive the relation. 6

✓(d) Entropy of a perfect gas. 6

✓3. Derive thermodynamic potentials of a perfect gas. How are they related to thermodynamical variables T, P, V and S ? 12

Or

State the limitations of Clausius-Clapeyron equation. Obtain the expression for the Ehrenfest equations. When does this equation fail? 4 + 6 + 2

✓4. Derive a relation between specific heat at constant pressure C_p , specific heat at constant volume C_v and gas constant R for one gram mole of an ideal gas. 12

Or

Using Maxwell's thermodynamic relations
prove that for any system : 6 + 6

$$(i) \quad Tds = C_V dT + T \left(\frac{\partial P}{\partial T} \right)_V dV$$

$$(ii) \quad \left(\frac{\partial U}{\partial V} \right)_T = T \left(\frac{\partial P}{\partial T} \right)_S - P$$

5. What is Brownian motion ? Give a brief account of Einstein's theory of translational Brownian motion. What is its significance ? 12

Or

Write short notes on :

- ✓(i) The virial equation 6
- ✓(ii) Free adiabatic expansion of a perfect gas. 6

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PHYSICS

(Digital Systems and Applications)

[Core]

Paper — VII

Full Marks : 60

Time : $2\frac{1}{2}$ hours

Answer all questions

The figures in the right-hand margin indicate marks

GROUP — A

1. Answer the questions : 3 × 4

(a) What is an IC ? Give its advantages.

(b) Draw the logic circuit of a half adder. Write its truth table.

(c) What is optical memory ? Name the devices based on it.

(Turn Over)

- (a) What are counters ? Mention different types of counters.**

GROUP – B

Answer all questions :

12 × 4

- 2. (a) State and prove De Morgan's 2nd theorem. 6**

- (b) Draw logic symbol of XOR gate and obtain its output. 3**

- (c) Convert $(11001)_2$ to octal. 3**

Or

- (a) What are logic gates ? Explain the realisation of 'AND' and 'OR' gates for two inputs using junction diodes. 8**

- (b) Explain how OR gate can be produced from single input NAND gates. 4**

- 3. (a) What are the components of CRO ? Derive expression for electrostatic deflection on the screen. 9**

- (b) Subtract 11011_2 from 11001_2 by 1's complement method.** 3

Or

- (a) What is IC555 timer ? Explain IC-555 timer as monostable multivibrator.** 8

- (b) Find the time for which the monostable IC-555 timer is on if $R = 5.0 \text{ k}\Omega$ and $C = 0.5 \mu\text{F}$.** 4

- 4. (a) What is meant by a microprocessor ? Explain functions of a microprocessor with block diagram.** 8

- (b) Distinguish between RAM and ROM.** 4

Or

- (a) What is magnetic memory ? Explain the working of Hard disk and floppy disk for recording digital information.** 9

- (b) The total storage capacity of a floppy disk**

having 80 tracks and storing 128 bytes/sector is 163840 bytes. Calculate the number of sectors of the disk.

3

5. (a) What is twisted ring counter ? Explain the function of a 4-bit twisted ring counter using J-K flip-flops.

6

(b) Explain the function of a 4-bit asynchronous decade counter using J-K flip-flops.

6

Or

(a) What is shift register ? Explain the working of 4-bit SISO and SIPO shift registers with their logic diagrams.

10

(b) What is a decade counter ? Why is it named so ?

2

2018

CHEMISTRY

[Generic Elective]

Paper — III

Full Marks : 60

Time : $2\frac{1}{2}$ hours

Answer all questions

The figures in the right-hand margin indicate marks

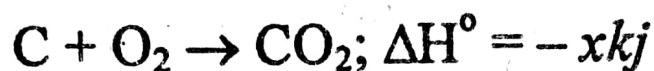
1. ~~(a)~~ Define standard states. 2
- ~~(b)~~ Define state function and path function. 4
- ~~(c)~~ Prove that at constant volume, $\Delta H = \Delta E$. 2
- (d) What is the amount of work done by the reaction of 5 gm of Zn with HCl in a closed vessel? 2
- ~~(e)~~ Define integral enthalpy of a solution. 2

(Turn Over)

Or

(a) What is the relationship between H and E ? 4

(b) Given that :



Find enthalpy of formation of CO_2 . 4

(c) State third law of thermodynamics. 2

(d) Define bond energy. 2

2. (a) Derive the relationship between K_p and K_c . 4

(b) What would happen to a reversible reaction at equilibrium when an inert gas is added? 2

(c) State law of mass action. Explain the law with one example. 6

Or

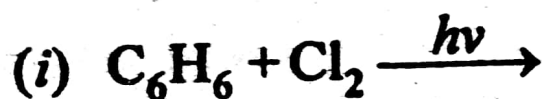
(a) Derive the expression for equilibrium constant for the following reaction,

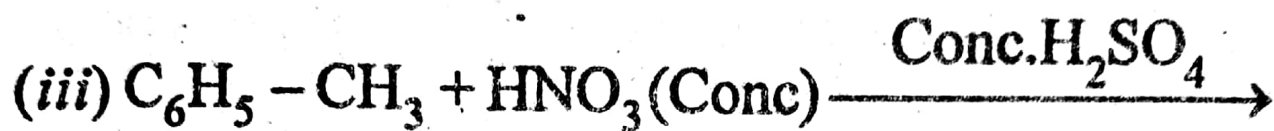
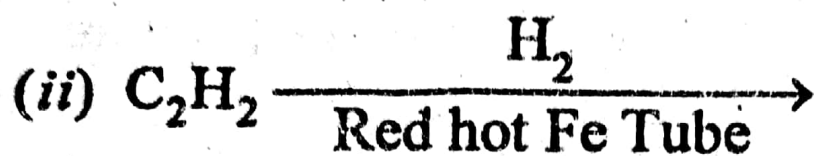


- (b) Define pH. What is the effect of temperature on pH ? 4
- (c) Why aqueous solution of K_2CO_3 is alkaline ? 4
3. (a) How can you prepare benzene from phenol ? 2
- (b) Explain the chlorination in Benzene. 2
- (c) What is the graphic formula of benzene ? 2
- (d) Explain Fridel-Crafts alkylation and acylation. 6

Or

- (a) Define Hückel's rule of aromaticity. 3
- (b) How can you obtain benzoic acid from benzene ? 3
- (c) Complete the following reactions : 6





4. (a) Explain which alkyl halides undergo nucleophilic substitution reaction? Explain with examples which alkyl halide undergo $\text{S}_{\text{N}}1$ and which alkyl halide undergo $\text{S}_{\text{N}}2$ reaction.

2 + 4 + 4

- (b) What happens when alkyl halides are heated with ethanolic silver cyanide?

2

Or

- (a) Write notes on :

8

(i) Gattermann reaction

(ii) Ulmann reaction

(iii) Fitting reaction

(iv) Hyndsdiecker reaction.

(b) How can you prepare :

4

- (i) Chlorobenzene from phenol
- (ii) Fluorobenzene from benzene diazonium chloride.

5. (a) Write notes on :

8

- (i) Reimer-Tiemann reaction
 - (ii) Etard reaction
 - (iii) Bouveault-Blanc reduction
 - (iv) Rosenmund's reaction.
- (b) What happens when ethyl bromide reacts with aqueous KOH ?
- (c) Why ethyl alcohol reacts with HI but not with HCN ?

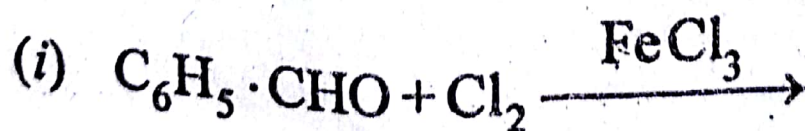
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2

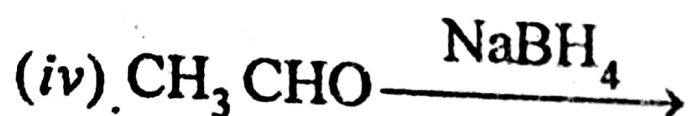
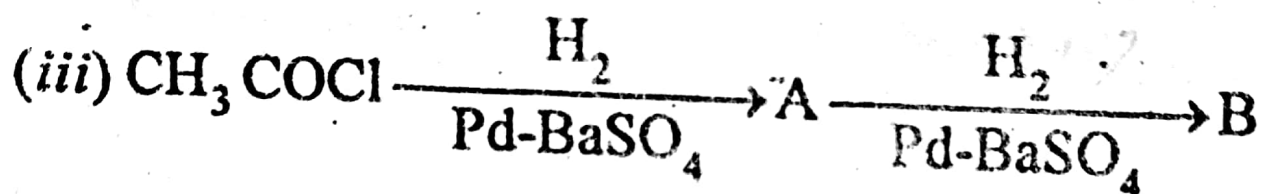
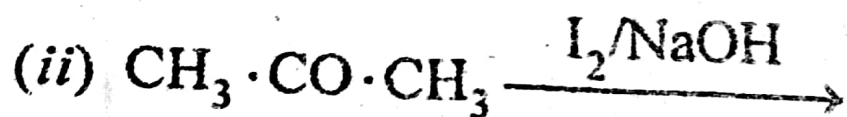
Or

(a) Complete the following reactions :

8



(6)



(b) How can you distinguish between formaldehyde and acetaldehyde ?

2

(c) How can you prepare monobromo phenol from phenol ?

2

2018

COMM. ENGLISH

[SEC]

Paper — I

Full Marks : 40

Time : 2 hours

Answer all questions

The figures in the right-hand margin indicate marks

1. Answer any one of the following : 8 × 1

(a) What is Communication ? Write different modes about verbal and non-verbal communication.

(b) What are barriers to communication ? How can these barrier be overcome ?

(Turn Over)

2. Answer any *one* of the following : 8×1

(a) How many functions does language perform ?
Briefly define these functions.

(b) Explain descriptive function with example.

3. Answer any *one* of the following : 8×1

(a) Why pronunciation is important for communication ? What does correct intonation means ?

(b) Briefly explain various methods of effective communication.

4. Answer any *one* of the following : 8×1

(a) Write a letter to your friend congratulating him on his success in Medical Entrance Examination.

(b) Submit a proposal to the principal of your college to organise a three day workshop on Communicative English for effective learning.

5. Answer any *two* of the following :

4 × 2

(a) Information Gap Principle

(b) Expressive Functions of Language

☒ (c) Mis-Communication and its Consequence

(d) Importance of Routine Message.
